Sub C3

WHAT IS CLAIMED IS :

1. Method for the estimation of one or more parameters of a propagation channel with a priori knowledge of the signal in a system comprising one or more sensors, wherein the method comprises the following steps:

- correlating the signal or signals x(t) received by the sensor or sensors with a known signal c(t),
- sampling said signal after correlation at a sampling period Te and selecting a number of samples per concatenation,
- determining at least one parameter of the propagation channel such as τ and/or θ which enables the most efficient reconstruction of the signals received by using a maximum likelihood method.

2. A method according to claim 1, wherein the characteristics of the system of sensors are known and wherein:

- the known signal c(t) is equal to 1,
- the signals received on the antenna are expressed in the form $X=S(\tau, \theta)h+B$
- the estimates of the parameters τ and θ are expressed in the following form:

$$\hat{\theta}, \hat{\tau} = \arg\min_{\theta,\tau} \left\|\Pi_S^{\perp}(\theta, \tau)X\right\|^2 = \arg\min_{\theta,\tau} \left\{X^{\dagger}\Pi_S^{\perp}(\theta, \tau)X\right\}$$

where $\Pi^{\perp}s$ is the projector orthogonal to the image generated by the column vectors of $S(\theta,\tau)$.

3. A method according to one of the claims 1 or 2, comprising a step for determining the complex amplitudes **h** of the impulse response of the propagation channel from the estimates of the estimated parameters τ and θ.

4. A method according to claim 1 wherein the characteristics of the system of sensors are not known, and the method comprises for example:

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- a step for the correlation of the signals received by the network of sensors with a known signal c(t) equal to 1,
- concatenated form $Y = \psi(\tau)\alpha+N$ where $\psi(\tau)$ is equal to the convoluted product of the unit matrix I_N and the matrix $\boldsymbol{S}(\tau) = [s^1(\tau_1^1), \cdots, s^1(\tau_{P_1}^1), \cdots, s(\tau_{P_U}^U)]$ and α contains the responses of the paths of the different users,
- a step for the estimation of the delay vectors τ from

$$\hat{\tau} = \arg\min_{\tau} \left\|\Pi_{\Psi}^{\perp}(\tau)Y\right\|^2 = \arg\min_{\tau} tr\left(Y^{\dagger}\Pi_{\Psi}^{\perp}(\tau)Y\right)$$

where $\Pi^{\perp}_{\Psi}$ is the projector orthogonal to the image generated by the line vectors of $\psi(\tau)$.

5. A method according to claim 1 comprising a step of correlation of the signals with a signal c(t) different from 1, wherein the characteristics of the system of sensors are known and this correlation step comprises a step for the estimation of the parameters τ and θ from

$$\theta, \tau = \arg\min_{\theta,\tau} \mathbf{X}^{\omega}\mathbf{R}_b^{-1}\Pi_{\Phi}^{\perp}(\theta,\tau)\mathbf{X}^{\omega}$$

$$\Pi_{\Phi}^{\perp} = \mathbf{I} - \Phi(\theta,\tau)\left(\Phi^{\dagger}(\theta,\tau)\mathbf{R}_b^{-1}\Phi(\theta,\tau)\right)^{-1}\Phi^{\dagger}(\theta,\tau)\mathbf{R}_b^{-1}$$

6. A method according to claim 1, comprising a step of correlation of the signals with a signal c(t) different from 1 wherein, the characteristics of the system of sensors being unknown, the estimation of the delay vector is expressed by means of:

$$\hat{\tau} = \arg\min_{\tau} \mathbf{Y}^{\omega}\mathbf{R}_n^{-1}\Pi_{\mathbf{S}}^{\perp}(\tau)\mathbf{Y}^{\omega}$$

where

$$\Pi_{\mathbf{S}}^{\perp} = \mathbf{I} - \mathbf{S}(\tau)\left(\mathbf{S}(\tau)\mathbf{R}_n^{-1}\mathbf{S}(\tau)\right)^{-1}\mathbf{S}(\tau)\mathbf{R}_n^{-1}$$

7 – ~~A method according~~ to one of the claims 1 to 6, applied in MIMO (Multiple Input Multiple Output) or SIMO (Single Input Single Output) type applications.

8. A device for estimating one or more parameters of a propagation channel with a priori knowledge of the signal in a system comprising one or more sensors, the device comprising $\boxed{\text{at least:}}$

- a device adapted to the correlation of the signal received by the sensor or sensors s(t) with a known signal c(t),
- a device adapted to the selection of a number of samples of the signal obtained after the correlation step, and
- a device ~~adapted to~~ the determining of the parameters of the channel by a maximum likelihood method.

9. A radiocommunications receiver comprising the characteristics of the device according to claim 8.

Sub A3 (cont.)